PTO 10-1416

CC=JP
DATE=19990209
KIND=KOKAI
PN=11035246

METHOD FOR DETECTING DEGRADATION OF MAIN ROPES OF ELEVATOR
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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. DECEMBER 2009
TRANSLATED BY SCHREIBER TRANSLATIONS, INC.

PUBLICATION COUNTRY	(10):	JAPAN
DOCUMENT NUMBER	(11):	11035246
DOCUMENT KIND	(12):	KOKAI
PUBLICATION DATE	(43):	19990209
APPLICATION NUMBER	(21):	09195705
APPLICATION DATE	(22):	19970722
INTERNATIONAL CLASSIFICATION	(51):	B 66 B 5/02 7/12
PRIORITY COUNTRY	(33):	N/A
PRIORITY NUMBER	(31):	N/A
PRIORITY DATE	(32):	N/A
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DESIGNATED CONTRACTING STATES	(81):	N/A
TITLE	(54):	METHOD FOR DETECTING DEGRADATION OF MAIN ROPES OF ELEVATOR
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Scope of Patent Claims

1. A method for detecting the degradation of main ropes of an elevator, characterized by the fact that in a method for detecting the degradation of a main rope of an elevator that is used for an elevator equipped with a hoister having a hoisting sheave and an electric motor, several main ropes which are wound on the above-mentioned hoisting sheave, a passenger car and a balance weight which are respectively connected to both ends of these several main ropes and ascend and descend in the directions opposite to each other, and a control part for controlling the operation of these passenger car and balance weight, the region where the above-mentioned passenger car relatively frequently travels is detected based on position signals of the above-mentioned passenger car which is input into the above-mentioned control part; a prescribed part of the main rope corresponding to the above-mentioned region is specified; and the prescribed part of the main rope is checked.

[1] Numbers in the margin indicate pagination in the foreign text.

2. The method for detecting the degradation of main ropes of an elevator of Claim 1, characterized by the fact that the region where the above-mentioned passenger car relatively frequently travels and its traveling times are calculated by totaling the position signals of the above-mentioned passenger car; and the calculated data and a preset decision value are compared to detect the region where the above-mentioned passenger car relatively frequently travels.

Detailed Description of the Invention

[0001]

(Technical Field of the Invention)

The present invention pertains to a method for detecting the degradation of main ropes of an elevator that is used in detecting the degradation state of main ropes.

[0002]

(Prior art)

Figure 6 is a vertical cross section that shows the entire constitution of a general elevator. Generally, in an elevator, as is shown in Figure 6, a hoister 2, control part 3, etc., are installed in an upper machine room 1, a hoistway 4 is formed below the upper machine room 1, and a passenger car 5 and a balance weight 6 ascend and descend

in the hoistway 4. Several main ropes 7 for suspending these passenger car 5 and balance weight 6 are wound on a hoisting sheave 8 and a deflector wheel 9 that rotate with the hoister 2, and the passenger car 5 and the balance weight 6 are respectively connected to both ends. These main ropes 7 transmits a driving force of the hoister 2 by a friction force with the hoisting sheave 8 to the passenger car 5 and the balance weight 6, so that the passenger car 5 and the balance weight 6 ascend and descend in the hoistway 4 in the directions opposite to each other. In addition, each one end of a compensating rope 10 and a tail cord 11 is connected to the bottom of the passenger car 5, and the other end of the compensating rope 10 is connected to the bottom of the balance weight 6.

[0003] In the elevator with this constitution, the main ropes 7 support the passenger car 5 and the balance weight 6, and the main ropes 7 transmit the driving force of the hoister 2. In other words, since the main ropes 7 are very important, it is necessary to prevent a fracture accident of the main ropes 7 by checking the degradation state of the main ropes 7.

[0004] Accordingly, the degradation state has been checked at each elevator traveling time by observing the above-mentioned main ropes 7 with the naked eyes of a maintenance

man. However, in the checking method with the naked eyes, it was necessary for the maintenance man to observe the entire length of the main ropes 7 with the naked eyes to decide which part of the main ropes 7 was degraded, considerable labor and time were required. In addition, for the above-mentioned periodic check at each elevator traveling time, the check was not necessarily carried out at a check interval fitting to the traveling situation of the elevator. For example, in case the traveling frequency of the elevator was relatively low, a useless check was carried out, whereas in case the traveling frequency of the elevator was relatively high, the check of the main ropes 7 was likely to be delayed.

[0005] Accordingly, as a means to solve these conventional problems, for example, as described in Japanese Kokai Patent Application No. Hei 6[1994]-286957, a method that measures the electric resistance value of the main ropes 7 in a state in which rope grooves of the hoister 2 and the deflector wheel 9 are insulated for each main rope, and detects the change of the main ropes 7 with a lapse of time by comparing the measured value with an initial value or electric resistance values of the other ropes, detecting the degradation such as element wire breakdown of the main ropes 7 is proposed.

[0006]

(Problems to be Solved by the Invention)

On the other hand, in the above-mentioned prior art, complicated labor was required for insulating the rope grooves of the hoister 2 and the deflector wheel 9, and it was also difficult to specify which part of the main ropes 7 was degraded.

[0007] The present invention considers the situation of the above prior art, and its purpose is to provide a method for detecting the degradation of main ropes of an elevator that can easily detect a local degradation of main ropes.

[0008]

(Means to Solve the Problems)

In order to achieve the above purpose, the present invention is characterized by the fact that in a method for detecting the degradation of a main rope of an elevator that is used for an elevator equipped with a hoister having a hoisting sheave and an electric motor, several main ropes which are wound on the above-mentioned hoisting sheave, a passenger car and a balance weight which are respectively connected to both ends of these several main ropes and ascend and descend in the directions opposite to each other, and a control part for controlling the operation of these passenger car and balance weight, the region where

the above-mentioned passenger car relatively frequently travels is detected based on position signals of the above-mentioned passenger car which is input into the above-mentioned control part; a prescribed part of the main rope corresponding to the above-mentioned region is specified; and the prescribed part of the main rope is checked.

[0009] In the present invention, as is mentioned above, the region where the passenger car relatively frequently travels is detected, and a prescribed part of the main ropes corresponding to the detected region, for example, a prescribed part that slides in contact with the hoisting sheave is specified, and the prescribed part is checked. Therefore, a local degradation of the main ropes, due to the sliding contact of the hoisting sheave, etc., can be easily detected.

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[0010]

(Examples of an Embodiment of the Invention)

Next, an embodiment of the method for detecting the degradation of main ropes of an elevator of the present invention will be explained based on the figures. Figure 1 explains the method for detecting the degradation of main ropes of an elevator as an embodiment of the present invention, Figure 2 explains the principle for detecting

the degradation of main ropes by the method for detecting the degradation of main ropes of an elevator of this embodiment, Figure 3 shows an example of traveling record data collected by the method for detecting the degradation of main ropes of an elevator of this embodiment, Figure 4 shows another example of traveling record data, and Figure 5 is a flow chart showing the processing sequence in detecting the degradation of main ropes by the method for detecting the degradation of main ropes of an elevator of this embodiment. Here, in Figures 1 and 2, the same symbols are given to parts equivalent to those shown in the above-mentioned Figure 6.

[0011] In the elevator shown in Figure 1, call buttons 13a-13e are respectively provided to floors 12a-12f at which a passenger car 5 stops sequentially, and call registering signals of the passenger car 5 which are output from each call button 13a-13e are introduced into a processing unit 14 of a control part 3 that is installed in a machine room 1. In addition, the processing unit 14 is connected to a monitoring center 16 via a telephone line 15.

[0012] Moreover, in the elevator, generally, if the passenger car 5 ascends in a region Aa between the first floor 12a and the second floor 12b and the balance weight 6 descends in the corresponding region Aa, main ropes 7 are

moved by a part 7a with a length of L. Furthermore, if the traveling times of the passenger car 5 in the region Aa between the first floor 12a and the second floor 12b increases, the times of the part 7a of the main ropes 7 that slides in contact with a hoisting sheave 8 is increased, and the degradation of the part 7a of the main ropes 7 tends to be advanced, compared with other parts. Therefore, the method for detecting the degradation of main ropes of this embodiment is invented by the correlation between the traveling times of the passenger car 5 and the degradation of the main ropes 7.

[0013] In this embodiment, the degradation of the main ropes 7 is detected according to the processing sequence of Figure 5. In other words, as a sequence S1, the call registering signals of the passenger car 5 that are output from each call button 13a-13e are input into the processing unit 14 of the control part 3. As a sequence S2, the traveling times of the passenger car 5 in the region Aa between the first floor 12a and the second floor 12b, the, traveling times in a region Ab between the second floor 12b and the third floor 12c, ……, and the traveling times in a region Ae between the (n-1)-th floor 12e and the n-th floor 12f are respectively calculated based on the above-mentioned call registering signals by the processing unit

14. As a result, for example, traveling record data 17a-17e of the passenger car 5 shown in Figure 3 and traveling record data 18a-18e of the passenger car 5 shown in Figure 4 are obtained.

[0014] Next, as a sequence S3, whether or not data with a degradation decision value (preset upper limit times) shown by a broken line L1 or smaller and data with an expected degradation value (times slightly smaller than the degradation decision value) shown by a broken line L2 or greater exist in the above-mentioned traveling record data is decided. At that time, for example, if the data 18e shown in Figure 4 is the degradation decision value shown by the broken line L1 or smaller and the predicted degradation value shown by the broken line L2 or greater, as a sequence S4, this state is reported to the monitoring center 16 via the telephone line 15 from the processing unit 14 of the control part 3, and it is notified that the degradation of the main ropes 7 in the region Ae between the (n-1)-th floor 12e and the n-th floor 12f for the above-mentioned data 18e is expected. Next, the flow returns to the above-mentioned sequence S1, call registering signals are input again into the processing unit 14 of the control part 3, and traveling record data of

the passenger car 5 are calculated and processed based on the above-mentioned call registering signals.

[0015] In addition, in the above-mentioned sequence S3, if it is decided that there is no data with the degradation decision value shown by the broken line L1 or smaller and with the expected degradation value shown by a broken line L2 or greater in the above-mentioned traveling record data, the flow proceeds to a sequence S5. It is then decided whether or not there are data exceeding the degradation decision value shown by the broken line L1. At that time, for example, in case the data 18a shown in Figure 4 exceeds the degradation decision value shown by the broken line L1, the region Aa between the first floor 12a and the second floor 12b for the above-mentioned data 18a is specified as a sequence S6, and the part 7a of the main ropes 7 corresponding to the region Aa is flickered as a sequence S7. As a result, in case it is decided that the degradation is seen in the part 7a of the main ropes 7 as a sequence S, the main ropes 7 are exchanged as a sequence S9. On the other hand, if it is decided that no degradation is no seen in the part 7a of the main ropes 7, as a sequence S10, though the main ropes 7 are not exchanged, since the traveling times is relatively high, the part 7a of the main ropes 7 is tracked and investigated

so that it will also be checked with a priority in the future.

[0016] Moreover, in the above-mentioned sequence S5, as is shown in Figure 3, if it is decided that there is no data exceeding the degradation decision value shown by the broken line L1, the flow returns to the above-mentioned sequence S1, call registering signals are input again into the processing unit 14 of the control part 3, and processing of traveling record data of the passenger car 5 is repeated based on the above-mentioned call registering signals.

[0017] In the embodiment with this constitution, which part of the main ropes 7 wound on the hoisting sheave 8 is degraded can be specified, easily detecting a local degradation of the main ropes 7.

[0018]

(Effects of the Invention)

According to the present invention with the above constitution, a local degradation of the main ropes can be easily detected, so that a main rope exchange in accordance with the degradation state of the main ropes being used can be carried out instead of a main rope exchange based on the elevator traveling time.

Brief Description of the Figures

Figure 1 explains the method for detecting the degradation of main ropes of an elevator as an embodiment of the present invention.

Figure 2 explains the principle for detecting the degradation of main ropes by the method for detecting the degradation of main ropes of an elevator of this embodiment.

Figure 3 shows an example of traveling record data collected by the method for detecting the degradation of main ropes of an elevator of this embodiment.

Figure 4 shows another example of traveling record data.

Figure 5 is a flow chart showing the processing sequence in detecting the degradation of main ropes by the method for detecting the degradation of main ropes of an

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elevator of this embodiment.

Figure 6 is a vertical cross section showing the entire constitution of a general elevator.

Explanation of symbols:

2 Hoister

3 Control part

5 Passenger car

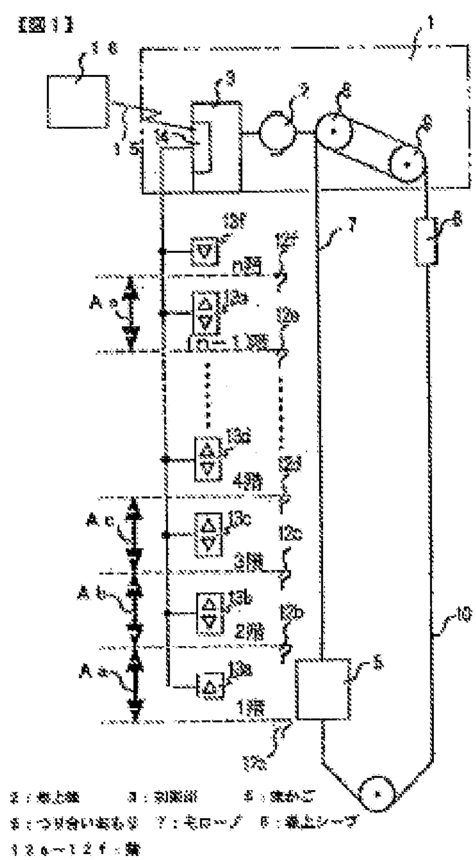
6 Balance weight

7 Main rope

8 Hoisting rope

12a-12f Floors

Figure 1:



2 Hoister

3 Control part

5 Passenger car

6 Balance weight

7 Main rope

8 Hoisting rope

12a-12f Floors

12a First floor

12b Second floor

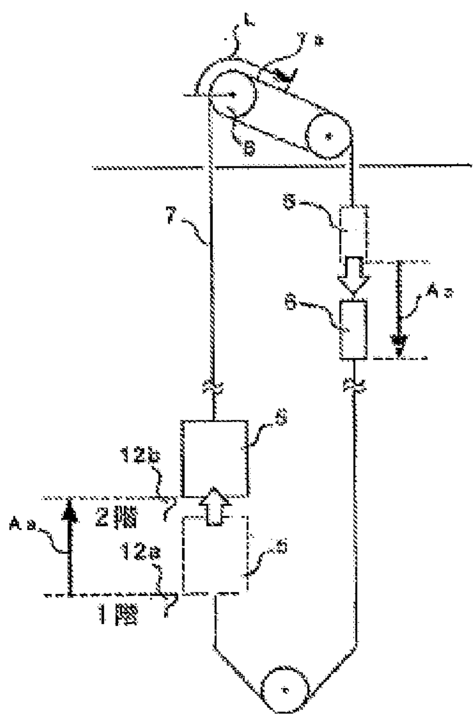
12c Third floor

12d Fourth floor

12e (n-)-th floor

12f n-th floor

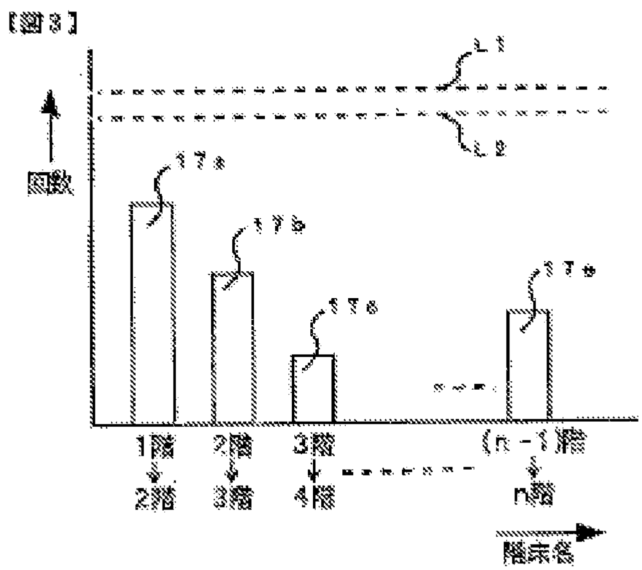
Figure 2:



12a First floor

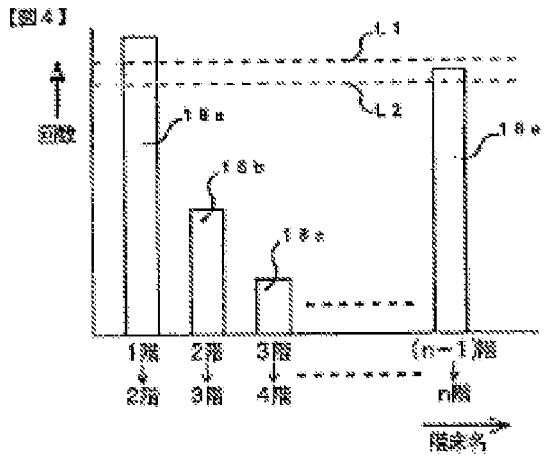
12b Second floor

Figure 3:



1. Times
2. First floor -> second floor
3. Second floor -> third floor
4. Third floor -> fourth floor
5. (n-1)-th floor -> n-th floor
6. Name of floor

Figure 4:



1. Times

2. First floor -> second floor

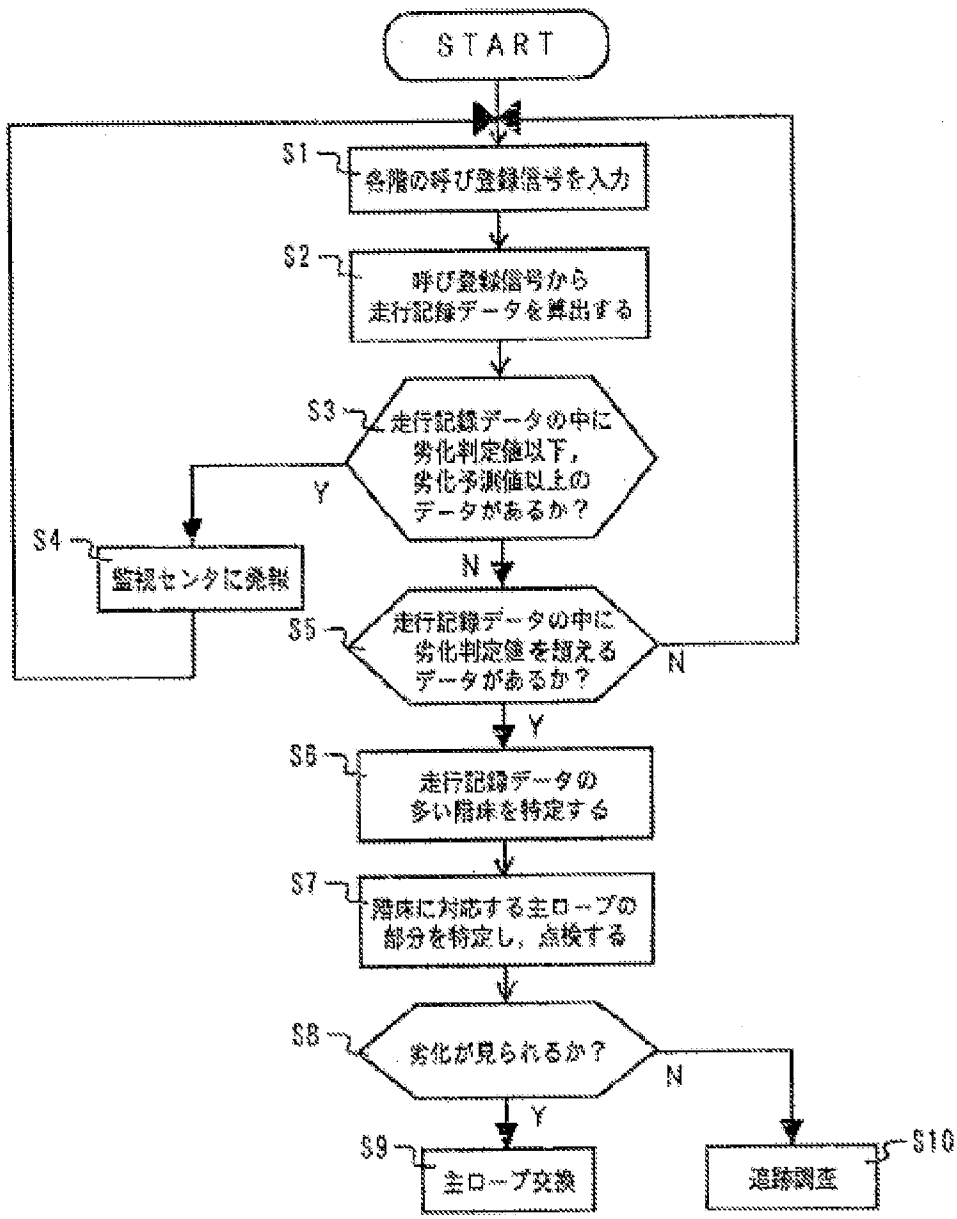
3. Second floor -> third floor

4. Third floor -> fourth floor

5. (n-1)-th floor -> n-th floor

6. Name of floor

Figure 5:



S1 Input of call registering signals of each floor

S2 Calculation of traveling record data from the call registering signals

S3 Are there data with a degradation decision value or smaller and an expected degradation value or greater in the traveling record data?

S4 Report to the monitoring center

S5 Is there a data exceeding the degradation decision value in the traveling record data?

S6 Specification of a floor with large traveling record data

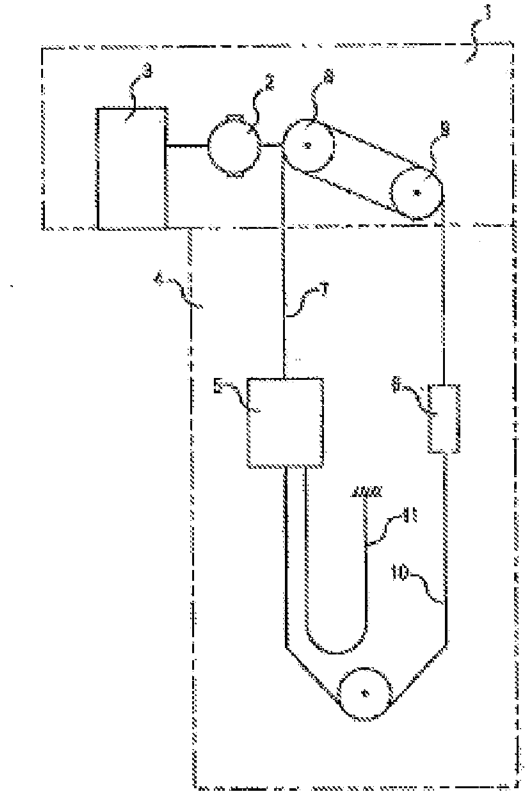
S7 Specification and check of a part of the main ropes corresponding to the floor

S8 Is the degradation seen?

S9 Main rope exchange

S10 Track and investigation

Figure 6



2 Hoister

3 Control part

4 Hoistway

5 Passenger car

6 Balance weight

7 Main rope

8 Hoisting rope

9 Deflector wheel

10 Compensating rope

11 Tail cord